

# Becoming climate-wise with Washington's water

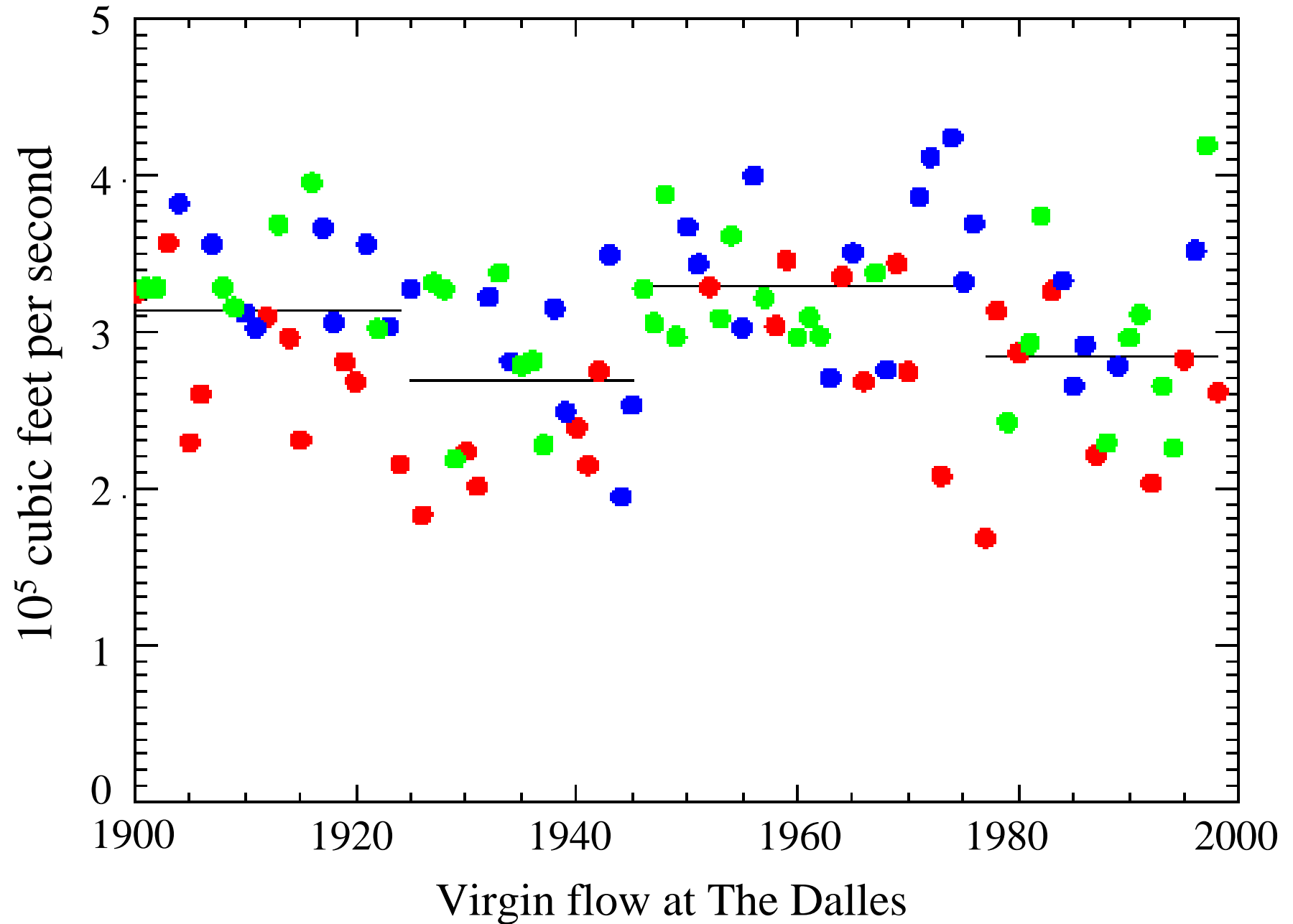


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# Columbia River April-September streamflow

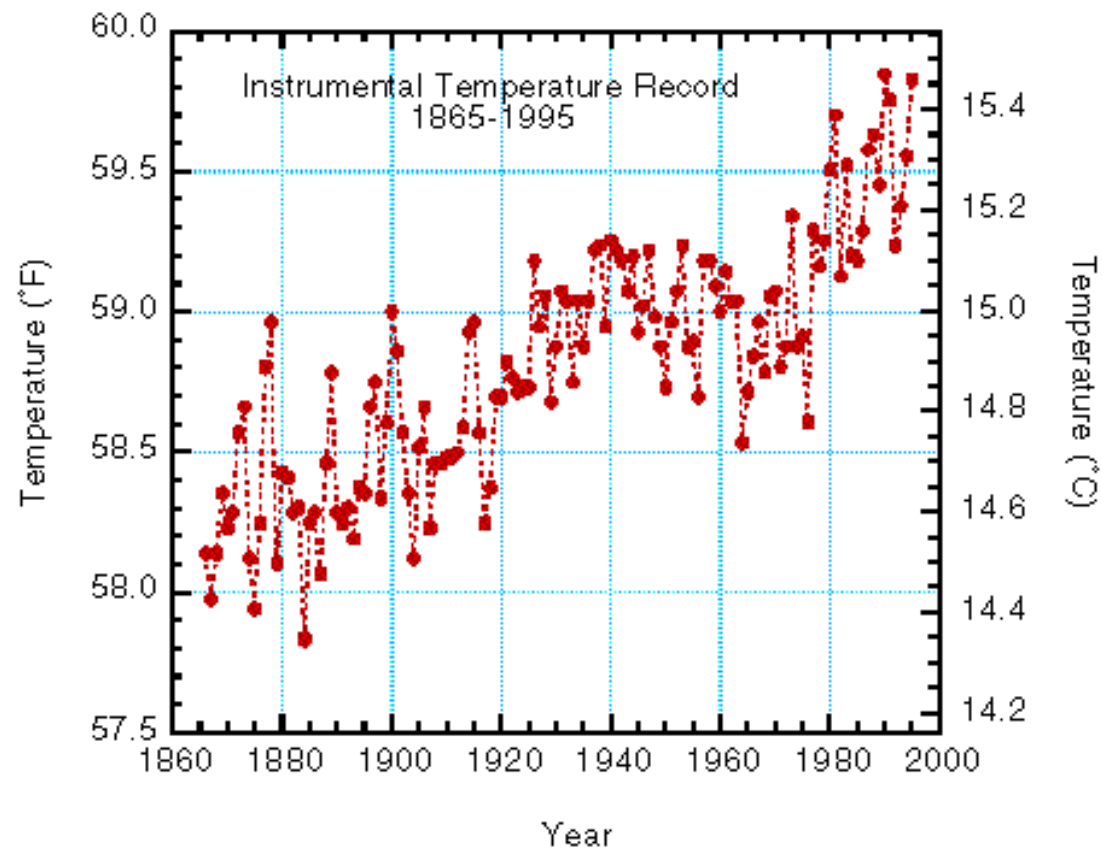


# Pacific Northwest: unique location



- Greatest sensitivity to Pacific Ocean
  - ENSO (El Nino-Southern Oscillation)
  - PDO (Pacific Decadal Oscillation)
- Columbia River flow can be predicted >1 year in advance
- Small variations in temperature and precipitation affect flow in a big way - what if they change?

# *Climate change in the past century*




# Scientific consensus on climate change



- Carbon dioxide and other greenhouse gases warm the planet
- Greenhouse gases have been increasing (CO<sub>2</sub> up 30%) and will increase for a long time
- The planet has warmed 0.6°C (1°F) since 1900
- Natural causes an unlikely explanation
- Further warming of 1.3-2.2°C (2-4°F) by the time of CO<sub>2</sub> doubling (2050-2100)

# What might climate change look like in the Northwest?



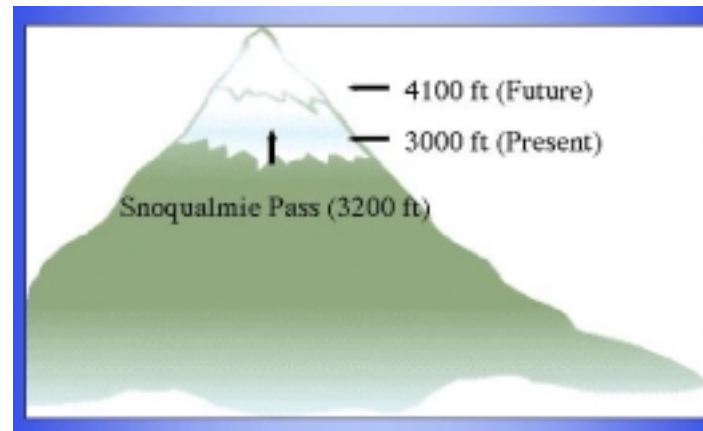
20th century warming: 1.5°F

the future: 10 scenarios of future climate

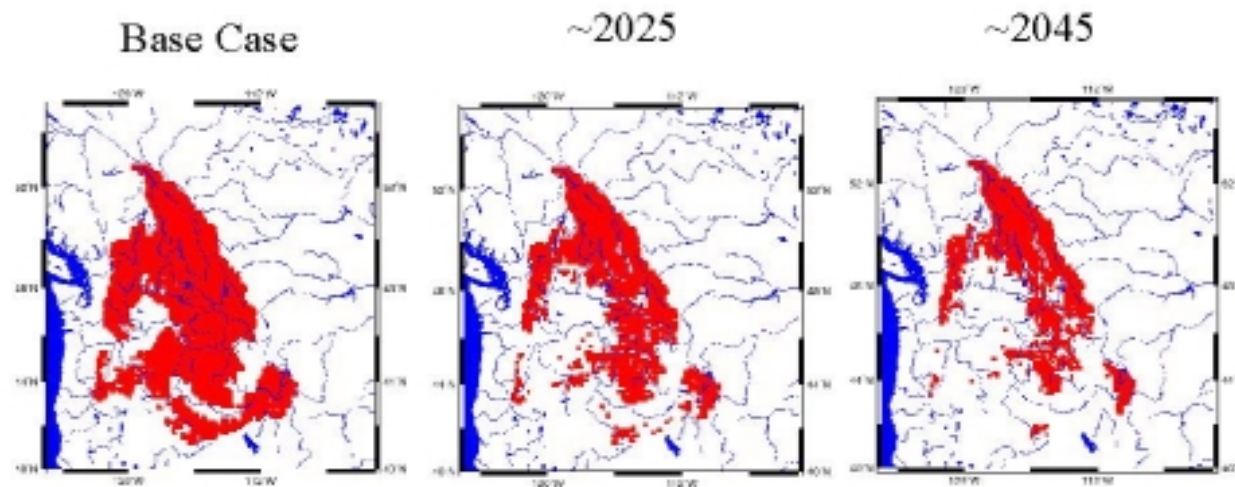
changes compared to 20th century average:

- 3.1°F warmer by 2020s (2.2°-3.7°)
- 5.3°F warmer by 2050s (4.6°-6.1°)
- wetter winters (Oct-Mar 0-22% increase)
- summers: models divided (-7% to +14%)

# The main impact: less snow



April 1  
Columbia  
Basin  
Snow  
Extent



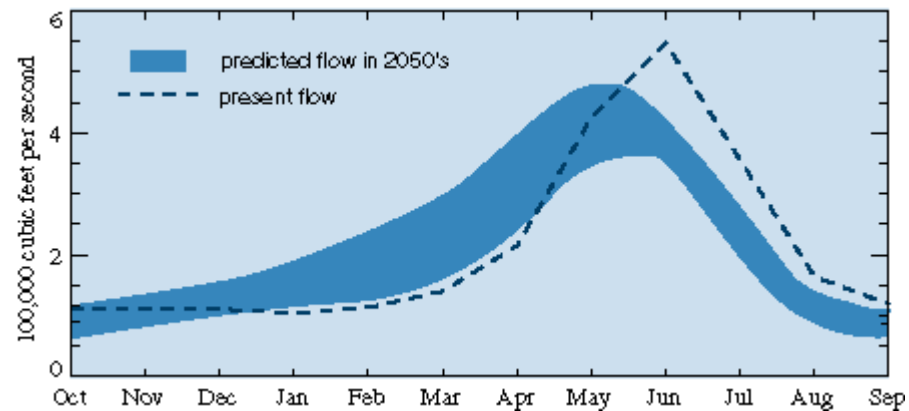
# Impacts of hydrologic changes

## ■ Less snow, earlier melt means less water in summer

- irrigation
- urban uses
- fisheries protection
- energy production

## ■ More water in winter

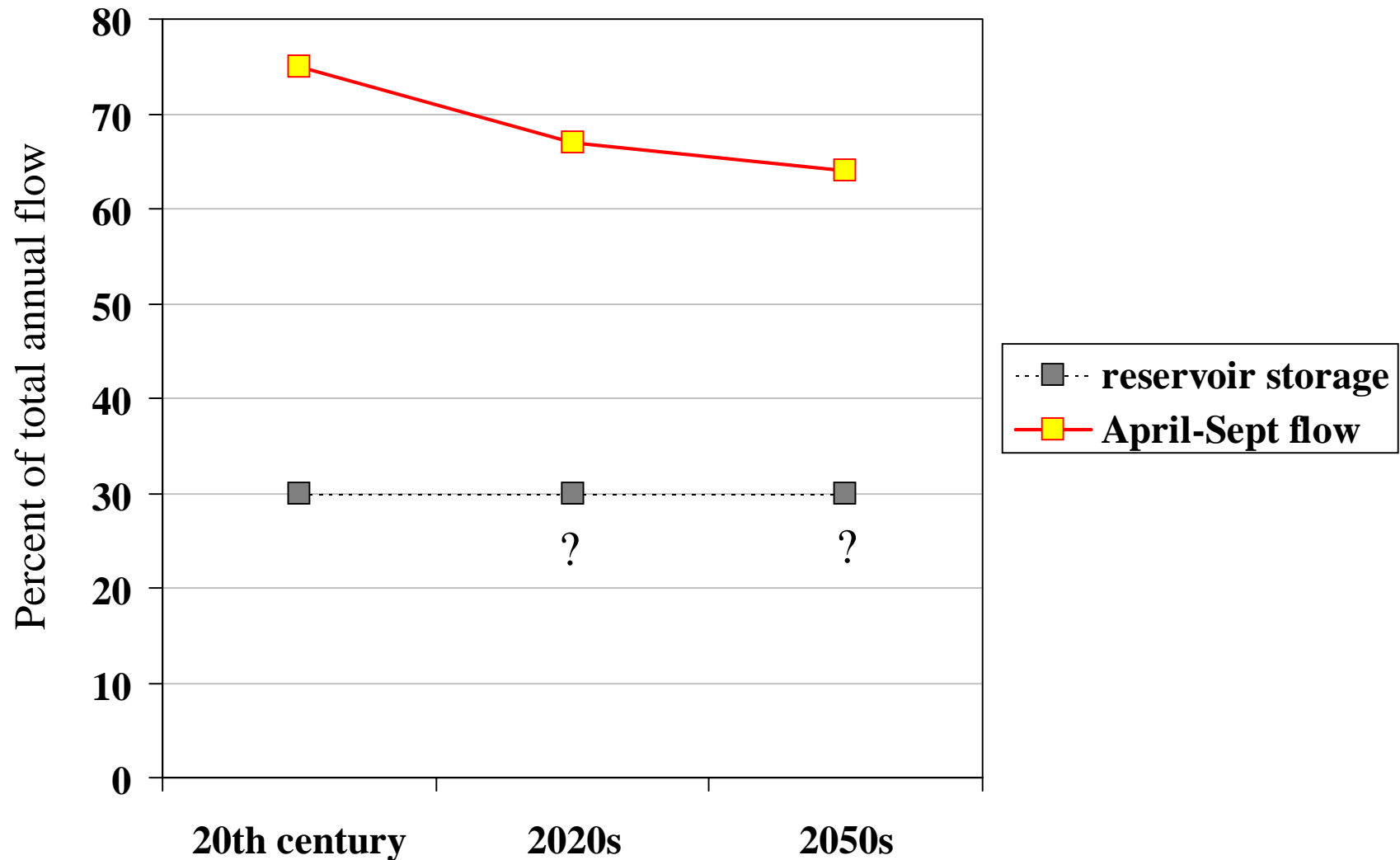
- energy production
- flooding



Natural Columbia River flow at the Dalles, OR.



# Storage of Columbia River water

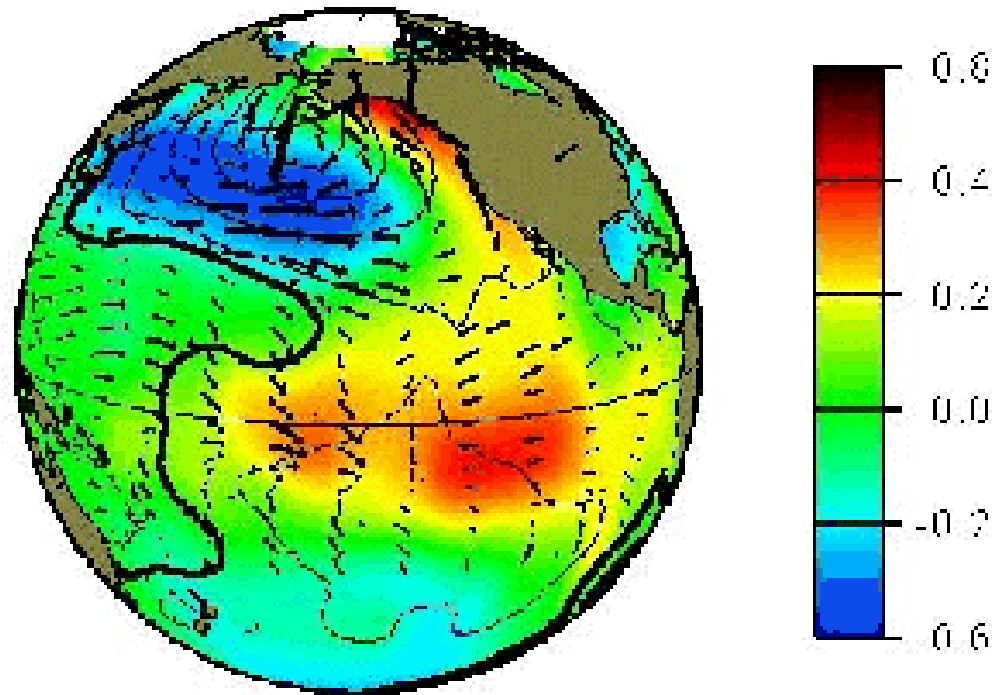


# Conclusions

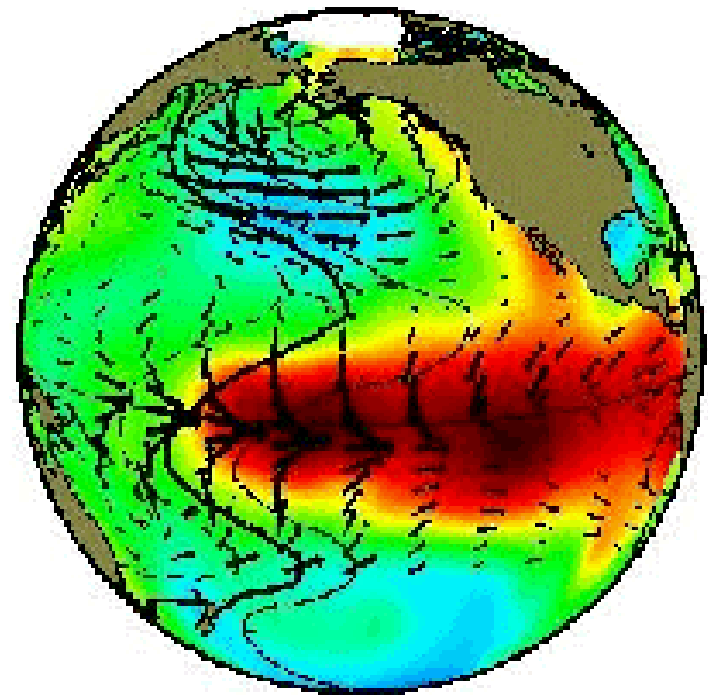


- Climate change likely to significantly affect the Pacific Northwest
- Main impact: reduction in snowpack, summer streamflow
- More dams? Or more flexible management?
- Consider climate a component of any long-term plan

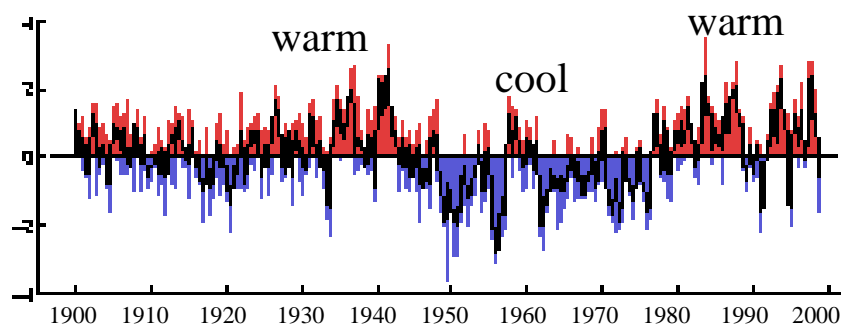
## Pacific Decadal Oscillation



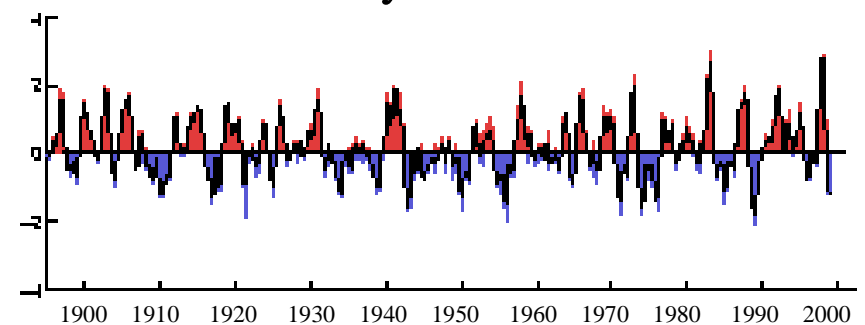
## El Niño/Southern Oscillation



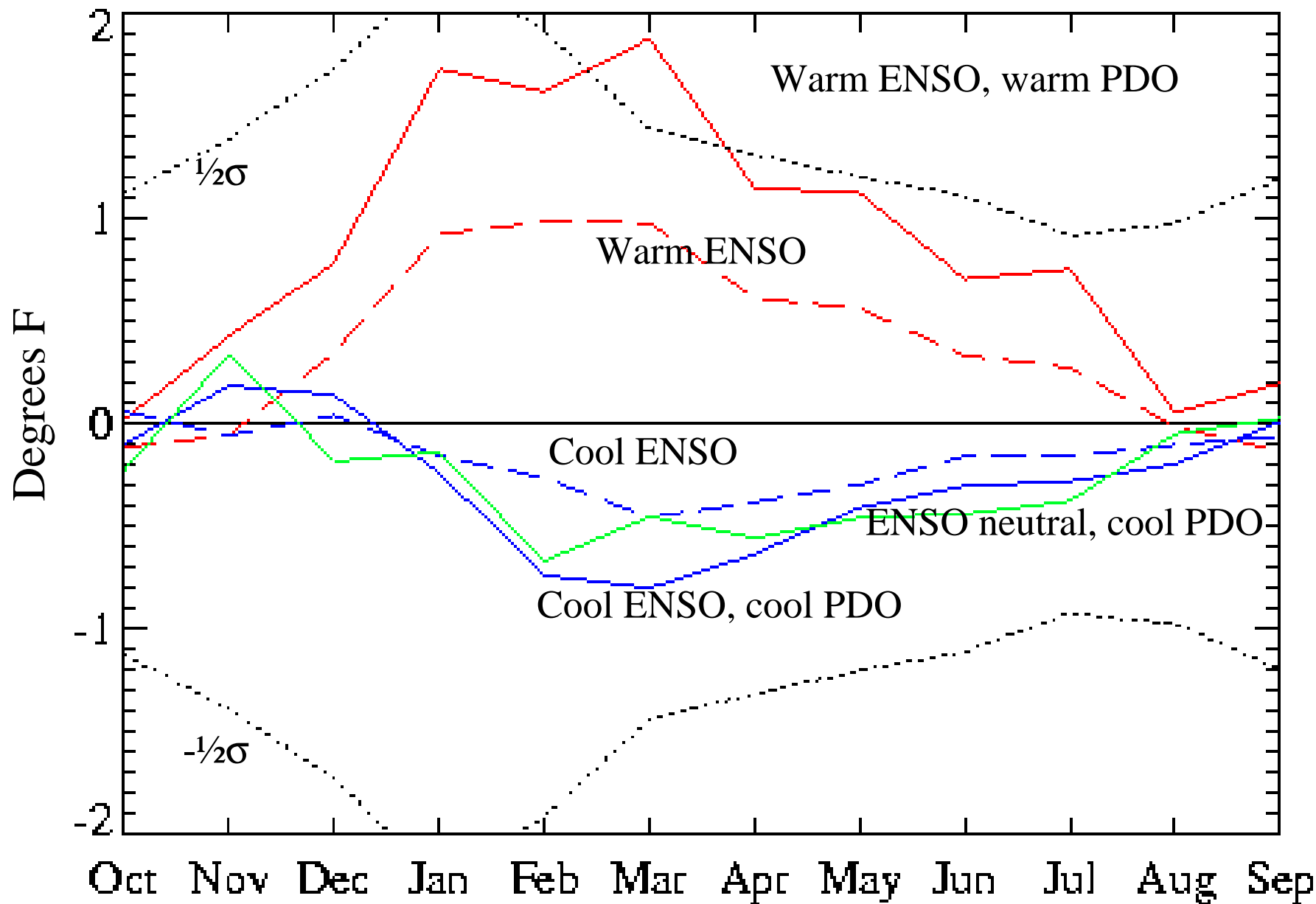
A history of the PDO



A history of ENSO



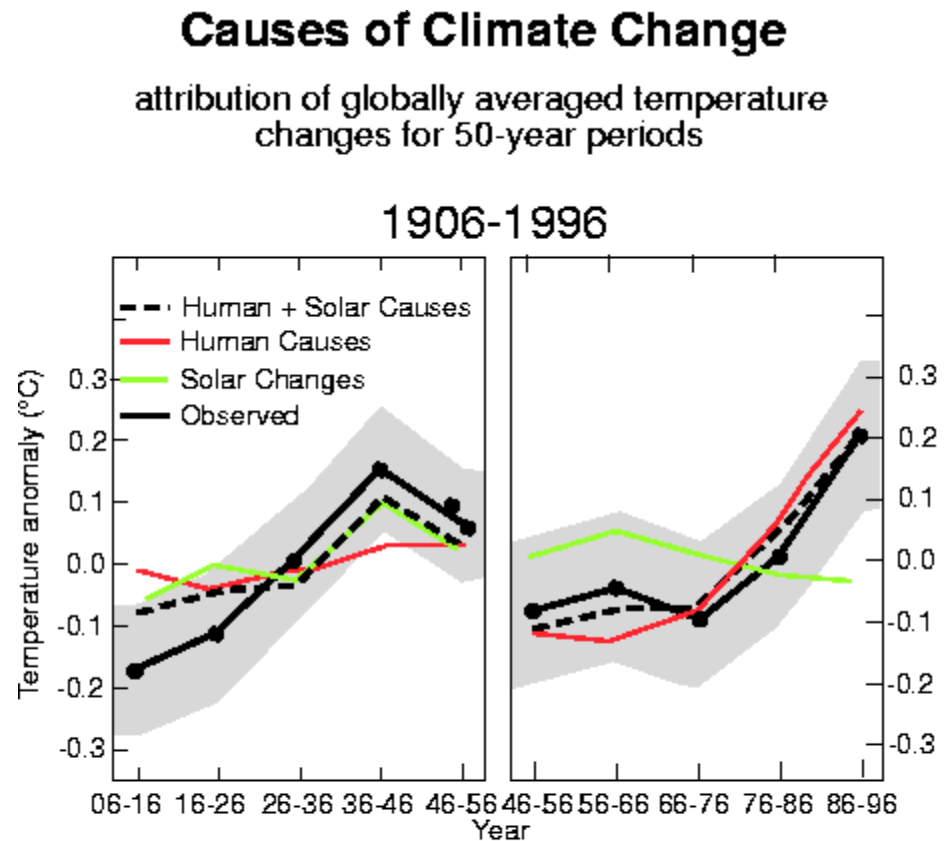
# Effects of PDO and ENSO on PNW average temperature



Years classified according to <http://www.atmos.washington.edu/~mantua/TABLES2.html>

# Whodunit?

- First half: nature
- Second half: us



from Tett et al Nature, vol. 399, pp 569-572, 1999